NASA Technical Memorandum 110391

Publications from Biomedical Research Conducted in the NASA Ames Research Center Human Research Facility: 1972–1995

J. E. Greenleaf, C. W. DeRoshia, V. L. Reyna, and K. A. Oswald

April 1996

National Aeronautics and
Space Administration

NASA Technical Memorandum 110391

Publications from Biomedical Research Conducted in the NASA Ames Research Center Human Research Facility: 1972–1995

J. E. Greenleaf, C. W. DeRoshia, V. L. Reyna, and K. A. Oswald,
Ames Research Center, Moffett Field, California

April 1996

National Aeronautics and
Space Administration

Ames Research Center
Moffett Field, California 94035-1000

Summary

Publications (abstracts, papers, and review articles) resulting from prolonged (> 24 hour) bed-rest projects and short-term (< 24 hour) head-down tilt or bed rest studies conducted on men and women in the Human Research Facility, Life Science Division at Ames Research Center, from 1972 to 1995 are presented herein. These publications report findings from (a) basic research into the mechanism(s) of human short-term adaptation and deconditioning during exposure to short- and long-term bed rest; (b) evaluation of countermeasures for the deleterious effects of both shifted timing of sleep-wake schedules and deconditioning utilizing bed rest as a simulation for spaceflight; and (c) development and evaluation of biomedical equipment and instrumentation for application to astronauts, general clinical medicine, and research.

Citations include mainly those documents that have been published in retrievable form; i.e., containing volume, pages, and year. Thus, some unpublished papers, meeting reports, and abstracts have been omitted.

An author index is provided.

Preface

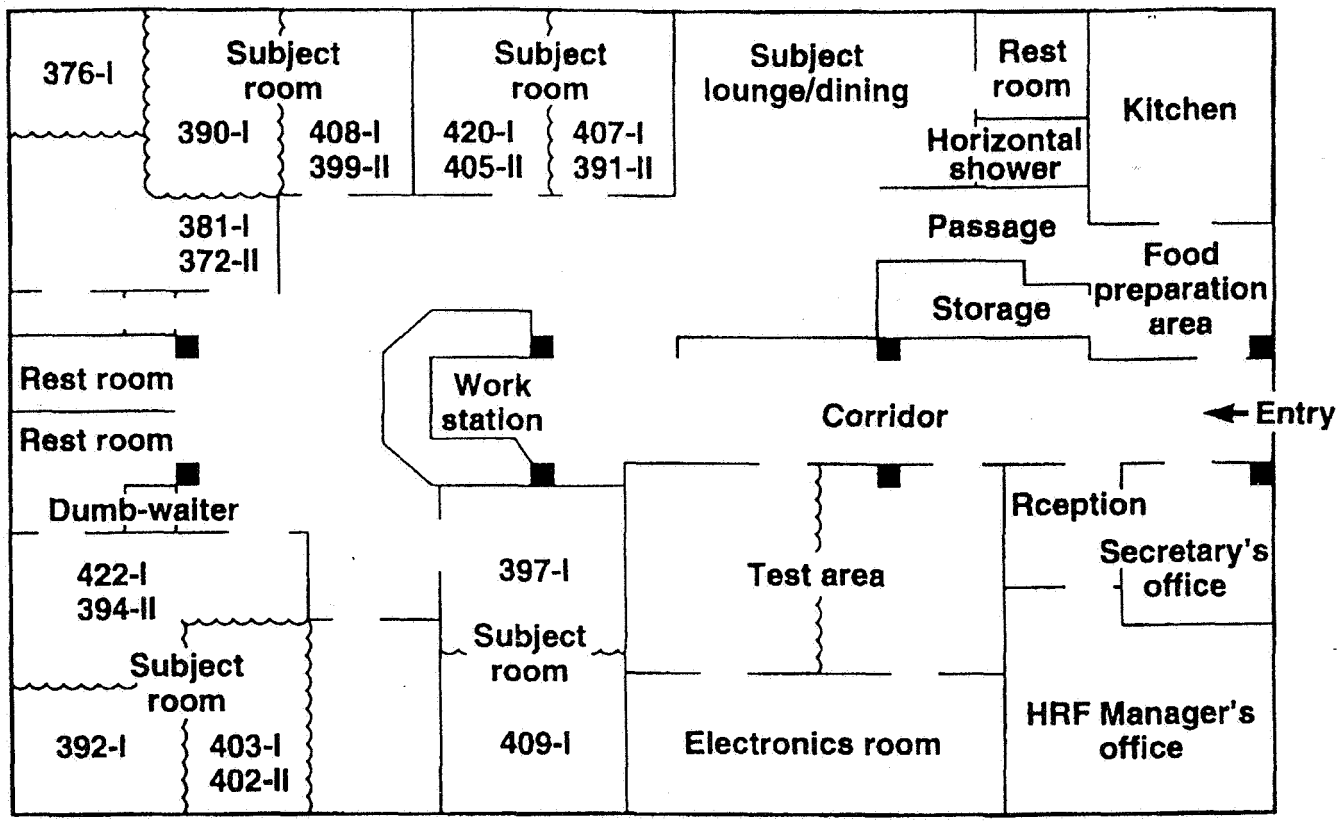
The first prolonged bed rest study (defined as test subjects confined to bed for at least 24 hours) performed at Ames Research Center in 1964 was in support of the Gemini program (162). The subjects were bed-rested in a mobile home parked in the lot adjacent to building N219 which, at that time, housed Electrical Services. Some Life Science laboratories (including mine) were located there while the new Life Sciences building (N239) was being constructed.

In 1969 inquiries were made at local hospitals for use of rooms to conduct bed-rest studies, with no success. Life Science management then requested and received funding to remodel existing space. A large laboratory on the first floor of the Life Sciences Building (N239) was redesigned in 1970; construction was completed while test subjects were undergoing their ambulatory control period for the initial study conducted there in 1971 (157, 169, 170, 220, 277, 278, 309, 311, 313).

After the second study, conducted in 1972 (19, 20, 81, 154, 178, 219, 277, 278, 282, 312, 313), Ms. Dolores (Dee) O'Hara, who had been a nurse for the astronauts at the Manned Spacecraft Center in Houston, arrived to manage these complicated studies in what came to be called the Human Research Facility (HRF) (143). The first bed rest study that utilized women as test subjects was conducted there in 1973 (20, 82, 157, 168, 208, 219, 287, 310, 324, 325, 326, 347, 349). Publication citations (including review papers) resulting from those bed rest projects and other human research studies (including head-down tilt bed rest for less than 24 hours) through 1995 are contained herein.

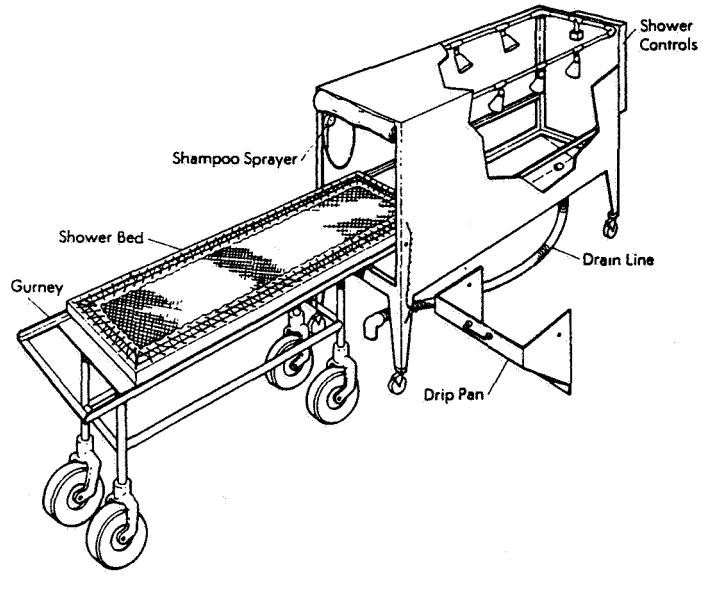
This Memorandum is dedicated to Ms. D. O'Hara for her untiring effort in the supervision and conduct of these many difficult human research studies in support of the manned space program.

J.E. Greenleaf



Human Research Facility plan. Wavy lines indicate moveable room partitions.

The Human Research Facility is a self contained unit that consists of two rooms with 4 beds each, two rooms with 2 beds each, (12 beds), a horizontal shower, a lounge-dining area, a kitchen and food preparation area, a nurses' work station, a physiological testing room, secretary and manager offices, rest rooms with showers for ambulatory subjects, and a dumb-waiter to transport samples to a laboratory above. Subject rooms have general fluorescent lighting, and incandescent lights and color TV sets above each bed controlled by the subjects. Headphones permit individual selection of AM/FM radio, network TV and videocassette TV.



Horizontal shower.

Publications from Biomedical Research Conducted in the NASA Ames Research Center Human Research Facility: 1972–1995

1 **Aburdene, M.F., H. Sandler, and D.J. Goldwater:**
Modeling of the heart rate response to LBNP in women.
Proceedings of the 17th Annual Pittsburgh Conference 17(Part 4):1229–1234, 1986.

2 **Aratow, M., A.R. Hargens, S.B. Arnaud, and J.-U. Meyer:**
Effect of simulated weightlessness on the postural response of microvascular cutaneous blood flow.
The Physiologist 33(Suppl.):S-54–S-55, 1990. (Abstract)

3 **Aratow, M., A.R. Hargens, J.-U. Meyer, and S.B. Arnaud:**
Postural responses of head and foot cutaneous microvascular flow and their sensitivity to bed rest.
Aviation, Space, and Environmental Medicine 62:246–251, 1991.

4 **Arnaud, S.B.:**
Bone density and calcium metabolism.
In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E.Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987,* 1993. p. 97–108.

5 **Arnaud, S., P. Berry, M. Cohen, J. Danellis, C. DeRoshia, J. Greenleaf, B. Harris, L. Keil, E. Bernauer, M. Bond, S. Ellis, P. Lee, R. Selzer, and C. Wade:**
Effects of exercise during prolonged bedrest.
NASA Tech Briefs 16:136–137, 1992.

6 **Arnaud, S., P. Berry, M. Cohen, J. Danellis, C. DeRoshia, J. Greenleaf, B. Harris, L. Keil, E. Bernauer, M. Bond, S. Ellis, P. Lee, R. Selzer, and C. Wade:**
Exercise countermeasures for bed rest deconditioning.
Washington, DC: *NASA Space Life Sciences Symposium: Three Decades of Life Science Research in Space,* 1987. p. 59–60. (Abstract)

7 **Arnaud, S.B., P. Fung, B. Harris, and R. Marcus:**
Effects of a human bed rest model for spaceflight on serum 1,25-dihydroxyvitamin D.
In: *Vitamin D. Gene Regulation Structure-Function Analysis and Clinical Application,* edited by A.W. Norman, R. Bouillion, and M. Thomasset. Berlin: Walter de Gruyter & Co., 1991. p. 915–916.

8 **Arnaud, S.B., P. Fung, J. Vernikos, and I. Wolinsky:**
Restriction of dietary salt reduces urinary calcium loss in a human space flight model.
Aviation, Space, and Environmental Medicine 64:423, 1993. (Abstract)

9 **Arnaud, S.B., R. Marcus, and J.E. Greenleaf:**
Suppression of the parathyroid/1,25-dihydroxyvitamin D axis during head down tilt bed rest can be prevented by exercise that loads the skeleton.
Endocrine Society Abstracts 1989. p. 470. (Abstract)

10 **Arnaud, S.B., and E. Morey-Holton:**
Gravity, calcium, and bone: Update, 1989.
The Physiologist 33(Suppl.):S-65–S-68, 1990.

11 **Arnaud, S.B., M. Powell, R. Marcus, P. Berry, B. Silver, and B. Harris:**
Bone, calcium, and muscle metabolism.
In: *Exercise Countermeasures for Bed Rest Deconditioning,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 31–34.

12 **Arnaud, S.B., M.R. Powell, J. Vernikos-Danellis, and P. Buchanan:**
Bone mineral and body composition after 30 day head down tilt bed rest.
Journal of Bone and Mineral Research 3(Suppl. 1):S119, 1988. (Abstract)

13 **Arnaud, S.B., M.R. Powell, R.T. Whalen, and J. Vernikos-Danellis:**
Bone mineral redistribution during head tilt bed rest.
American Society for Gravitational and Space Biology Bulletin 2:54, 1989. (Abstract)

14 **Arnaud, S.B., D.J. Sherrard, N. Maloney, R.T. Whalen, and P. Fung:**
Reduced bone formation is measurable in the iliac crest of normal men after 7 days in a bed rest model of weightlessness.
Journal of Bone and Mineral Research 4(Suppl. 1):S233, 1989. (Abstract)

15 **Arnaud, S.B., D.J. Sherrard, N. Maloney, R.T. Whalen, and P. Fung:**
Effects of 1-week head-down tilt bed rest on bone formation and the calcium endocrine system.
Aviation, Space, and Environmental Medicine 63:14–20, 1992.

16 **Arnaud, S.B., C.R. Steele, T. Hutchinson, K. Myburgh, and R. Marcus:**
Evaluation of tibial bone strength by a non-invasive direct measure of its bending stiffness, EI.
Aviation, Space, and Environmental Medicine 62:469, 1991. (Abstract)

17 **Arnaud, S.B., R.T. Whalen, T. Hutchinson, C. Snow-Harter, and R. Marcus:**
Regional mineral distribution in exercising and non-exercising men.
Journal of Bone and Mineral Research 6(Suppl. 1):S223, 1991. (Abstract)

18 **Ballard, R.E., J.R. Styf, D.E. Watenpaugh, K. Fechner, Y. Haruna, N.J. Kahan, and A.R. Hargens:**
Head-down tilt with balanced traction as a model for simulating spinal acclimation to microgravity.
American Society for Gravitational and Space Biology Bulletin 8:19, 1994. (Abstract)

19 **Bernauer, E.M., V.A. Convertino, R.W. Stremel, and J.E. Greenleaf:**
Cardiorespiratory deconditioning following 14 days bedrest: Salutary effects of static and dynamic exercise regimens.
Medicine and Science in Sports 7:83, 1975. (Abstract)

20 **Bernauer, E.M., J. Kollias, J.E. Greenleaf, and W. Van Beaumont:**
Plasma volume and electrolyte shifts during $+G_Z$ acceleration before and after bed rest.
Aerospace Medical Association Preprints, 1975. p. 181–182.

21 **Bernauer, E.M., W.F. Walby, A.C. Ertl, P.T. Dempster, M. Bond, and J.E. Greenleaf:**
Knee-joint proprioception during 30-day 6° head-down bed rest with isotonic and isokinetic exercise training.
Aviation, Space, and Environmental Medicine 65:1110–1115, 1994.

22 **Bernauer, E.M., W.F. Walby, A.C. Ertl, P.T. Dempster, and J.E. Greenleaf:**
Knee-joint proprioceptive sense-response during 30-day 6° head-down bed rest with isotonic and isokinetic exercise training.
In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 45–51.

23 **Berry, J.J., L.D. Montgomery, D. Goldwater, J. Bagian, and H. Sandler:**
Hemodynamic response of women 46 to 55 years to $+G_Z$ acceleration before and after bed rest.
Aerospace Medical Association Preprints, 1980. p. 70–71.

24 **Blamick, C.A., D.J. Goldwater, and V.A. Convertino:**
Vascular smooth muscle alpha receptor responsiveness during acute orthostasis following simulated weightlessness.
The Physiologist 28:345, 1985. (Abstract)

25 **Blamick, C.A., D.J. Goldwater, and V.A. Convertino:**
Leg vascular responsiveness during acute orthostasis following simulated weightlessness.
Aviation, Space, and Environmental Medicine 59:40–43, 1988.

26 **Breit, G.A., D.E. Watenpaugh, R.E. Ballard, and A.R. Hargens:**
Acute cutaneous flow and volume responses to whole-body tilting in humans.
Federation of American Societies for Experimental Biology Journal 6:A1771, 1992. (Abstract)

27 **Breit, G.A., D.E. Watenpaugh, R.E. Ballard, and A.R. Hargens:**
Acute cutaneous microvascular flow responses to whole-body tilting in humans.
Microvascular Research 46:351–358, 1993.

28 **Breit, G.A., D.E. Watenpaugh, R.E. Ballard, G. Murthy, and A.R. Hargens:**
Regional microvascular bloodflow during gravitational and LBNP stresses.
NASA Ames Research Center, Moffett Field, CA: *1992 Research and Technology*, 1992. p. 198–199.

29 **Breit, G.A., D.E. Watenpaugh, R.E. Ballard, G. Murthy, and A.R. Hargens:**
Cutaneous microvascular flow responses during head-up tilt, centrifugation, and LBNP stresses.
Federation of American Societies for Experimental Biology Journal 7:A666, 1993. (Abstract)

30 **Breit, G.A., D.E. Watenpaugh, R.E. Ballard, G. Murthy, and A.R. Hargens:**
Regional cutaneous microvascular flow responses during gravitational and LBNP stresses.
The Physiologist 36(Suppl.):S-110–S-111, 1993.

31 **Breit, G.A., D.E. Watenpaugh, T.M. Buckley, R.E. Ballard, G. Murthy, and A.R. Hargens:**
Peripheral microvascular responses to whole-body tilting, G_Z centrifugation, and lower body negative pressure stresses in humans.
American Society for Gravitational and Space Biology Bulletin 8:66, 1994. (Abstract)

32 **Breit, G.A., D.E. Watenpaugh, and A.R. Hargens:**
Acute blood-volume redistribution with posture.
NASA Ames Research Center, Moffett Field, CA: *1991 Research and Technology*, 1991. p. 231–232.

33 **Buchanan, P., and V.A. Convertino:**
A study of the effects of prolonged simulated microgravity on the musculature of the lower extremities in man: An introduction.
Aviation, Space, and Environmental Medicine 60:649–652, 1989.

34 **Catalano, G.T., C.M. Winget, L.F. Chapman, H. Sandler, C.W. DeRoshia, P.J. Haro, and L.W. Chu:**
Averaging methods in measuring motor activity and its relationship with sleep, heart rate and drugs.
In: *Proceedings of the San Diego Biomedical Symposium*, Vol. 17, edited by J.I. Martin, and E.A. Calvert. New York: Academic Press, Inc., 1978. p. 317–327.

35 **Catalano, G.T., C.M. Winget, A. Laursen, H. Sandler, C.W. DeRoshia, and J. Reitman:**
The measurement of motor activity during bedrest and ambulation.
In: *Proceedings of the San Diego Biomedical Symposium*, Vol. 16, edited by J.I. Martin. New York: Academic Press, Inc., 1977. p. 375–385.

36 **Catalano, G.T., C.M. Winget, B. Ragent, and H. Sandler:**
Techniques for measuring motor activity.
Proceedings of the 28th Annual Conference on Engineering Medicine and Biology 17:114, 1975. (Abstract)

37 **Chambers, A., and H.C. Vykukal:**
The Effects of Bed Rest on Crew Performance During Simulated Shuttle Reentry. Vol. I: Study Overview and Physiological Results.
Washington, DC: *NASA Technical Note D–7503*, 1974. 29 p.

38 **Chambers, A.B., and H.C. Vykukal:**
A study to determine the effects of bed rest on pilot performance and physiological responses during simulated space shuttle reenty.
Aerospace Medical Association Preprints, 1975. p. 139–140.

39 **Chang, D., G.A. Breit, J. Styf, and A.R. Hargens:**
Cutaneous microvascular flow in the foot in various gravitational environments.
NASA Ames Research Center, Moffett Field, CA: *1993 Research and Technology*, 1993. p. 184–186.

40 **Chang, D.S., G.A. Breit, J.R. Styf, and A.R. Hargens:**
Cutaneous microvascular flow in the foot during Earth, Mars, Moon and microgravities.
American Society for Gravitational and Space Biology Bulletin 7:60, 1993. (Abstract)

41 **Chapman, L.F., C.M. Winget, and J. Vernikos-Danellis:**
Flight-task performance capability during 21 days simulated weightlessness and intermittent gravitational stress.
Aerospace Medical Association Preprints, 1976. p. 221.

42 **Cohen, M.M:**
Posture, equilibrium, and gait.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 27–30.

43 **Cohen, M.M.:**
Balance and gait.
In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 73–75.

44 **Convertino, V.:**
Cardiorespiratory responses to exercise after bed rest (BR) in 45 to 55 year old men and women.
Aerospace Medical Association Preprints, 1979. p. 47–48.

45 **Convertino, V.A.:**
Effect of orthostatic stress on exercise performance after bed rest: Relation to inhospital rehabilitation.
Journal of Cardiac Rehabilitation 3:660–663, 1983.

46 **Convertino, V.A.:**
Exercise responses after inactivity.
In: *Inactivity: Physiological Effects*, edited by H. Sandler, and J. Vernikos. Orlando: Academic Press, Inc., 1986. p. 149–191.

47 **Convertino, V.A.:**
Potential benefits of maximal exercise just prior to return from weightlessness.
Aviation, Space, and Environmental Medicine 57:494, 1986. (Abstract)

48 **Convertino, V.A.:**
Potential benefits of maximal exercise just prior to return from weightlessness.
Aviation, Space, and Environmental Medicine 58:568–572, 1987.

49 **Convertino, V.A.:**
Effects of exercise and inactivity on intravascular volume and cardiovascular control mechanisms.
Acta Astronautica 27:123–129, 1992.

50 **Convertino, V.A.:**
Exercise training: Blood pressure responses in subjects adapted to microgravity.
Society of Automotive Engineers Transactions Journal of Aerospace 100:1380–1386, 1991.

51 **Convertino, V.A.:**
Exercise and adaptation to microgravity environments.
In: *Handbook of Physiology: Section 4: Environmental Physiology. III: The Gravitational Environment*, edited by M.J. Fregly, and C.M. Blatteis. New York: Oxford University Press. Vol. II, Chapt. 36, 1996. p. 815–843.

52 **Convertino, V.A., B.A. Benjamin, L.C. Keil, and H. Sandler:**
Role of cardiac volume receptors in the control of ADH release during acute simulated weightlessness in man.
The Physiologist 27(Suppl.):S-51–S-52, 1984.

53 **Convertino, V.A., R. Bisson, R. Bates, D. Goldwater, and H. Sandler:**
Role of orthostatic factors in the mechanism of cardiorespiratory deconditioning following bed rest.
Aerospace Medical Association Preprints, 1980. p. 26–27.

54 **Convertino, V.A., R. Bisson, R. Bates, D. Goldwater, and H. Sandler:**
Effects of antiorthostatic bedrest on the cardiorespiratory responses to exercise.
Aviation, Space, and Environmental Medicine 52:251–255, 1981.

55 **Convertino, V.A., D.F. Doerr, D.L. Eckberg, J.M Fritsch, and J. Vernikos-Danellis:**
Carotid baroreflex response following 30 days exposure to simulated microgravity.
The Physiologist 32(Suppl.):S-67–S-68, 1989.

56 **Convertino, V.A., D.F. Doerr, D.L. Eckberg, J.M. Fritsch, and J. Vernikos-Danellis:**
Head-down bed rest impairs vagal baroreflex responses and provokes orthostatic hypotension.
Journal of Applied Physiology 68:1458–1464, 1990.

57 **Convertino, V.A., D.F. Doerr, D.A. Ludwig, and J. Vernikos:**
Effect of simulated microgravity on cardiopulmonary baroreflex control of forearm vascular resistance.
American Journal of Physiology 266:R1962–R1969, 1994.

58 **Convertino, V.A., D.F. Doerr, K.L. Mathes, S.L. Stein, and P. Buchanan:**
Changes in volume, muscle compartment, and compliance of the lower extremities in man following 30 days of exposure to simulated microgravity.
Aviation, Space, and Environmental Medicine 60:653–658, 1989.

59 **Convertino, V.A., D.F. Doerr, and S.L. Stein:**
Changes in size and compliance of the calf after 30 days of simulated microgravity.
Journal of Applied Physiology 66:1509–1512, 1989.

60 **Convertino, V.A., D.F. Doerr, and J. Vernikos:**
Altered baroreflex control of forearm vascular resistance during simulated microgravity.
Journal of Gravitational Physiology 1:P-31–P-32, 1994.

61 **Convertino, V.A., and K.A. Engelke:**
Restoration of plasma volume induced by a single bout of maximal exercise after 16 days of simulated microgravity.
Aviation, Space, and Environmental Medicine 64:458, 1993. (Abstract)

62 **Convertino, V.A., and K.A. Engelke:**
Catecholamine response to maximal exercise after exposure to 16 days of simulated microgravity.
Medicine and Science in Sports and Exercise 27:S108, 1995. (Abstract)

63 **Convertino, V.A., D.J. Goldwater, and H. Sandler:**
Cardiorespiratory responses to exercise after bed rest in 55 to 65 year old men.
Aerospace Medical Association Preprints, 1981. p. 59-61.

64 **Convertino, V.A., D.J. Goldwater, and H. Sandler:**
Effect of orthostatic stress on exercise performance after bedrest.
Aviation, Space, and Environmental Medicine 53:652–657, 1982.

65 **Convertino, V.A., D.J. Goldwater, and H. Sandler:**
Oxygen uptake kinetics of constant-load work: Upright vs. supine exercise.
Aviation, Space, and Environmental Medicine 55:501–506, 1984.

66 **Convertino, V.A., D.J. Goldwater, and H. Sandler:**
$\dot{V}O_2$ kinetics of constant-load exercise following bed-rest-induced deconditioning.
Journal of Applied Physiology 57:1545–1550, 1984.

67 **Convertino, V.A., D.J. Goldwater, and H. Sandler:**
Bedrest-induced peak $\dot{V}O_2$ reduction associated with age, gender, and aerobic capacity.
Aviation, Space, and Environmental Medicine 57:17–22, 1986.

68 **Convertino, V.A., G.M. Karst, S.M. Kinzer, D.A. Williams, and D.J. Goldwater:**
Exercise capacity following simulated weightlessness in trained and nontrained subjects.
Aviation, Space, and Environmental Medicine 56:489, 1985. (Abstract)

69 **Convertino, V.A., G.M. Karst, C.R. Kirby, and D.J. Goldwater:**
Bedrest deconditioning reduces the hyperventilatory threshold.
Medicine and Science in Sports and Exercise 16:111, 1984. (Abstract)

70 **Convertino, V.A., G.M. Karst, C.R. Kirby, and D.J. Goldwater:**
Effect of simulated weightlessness on exercise-induced anaerobic threshold.
Aviation, Space, and Environmental Medicine 57:325–331, 1986.

71 **Convertino, V.A., C.R. Kirby, G.M. Karst, and D.J. Goldwater:**
Exercise capacity following repeat simulated shuttle flight.
Aviation, Space, and Environmental Medicine 55:443, 1984. (Abstract)

72 **Convertino, V.A., C.R. Kirby, G.M. Karst, and D.J. Goldwater:**
Response to muscular exercise following repeated simulated weightlessness.
Aviation, Space, and Environmental Medicine 56:540–546, 1985.

73 **Convertino, V.A., L.D. Montgomery, and J.E. Greenleaf:**
Cardiovascular responses during orthostasis: Effect of an increase in $\dot{V}O_2$ max.
Aviation, Space, and Environmental Medicine 55:702–708, 1984.

74 **Convertino, V., L. Olsen, D. Goldwater, and H. Sandler:**
Cardiorespiratory responses to exercise after bed rest (BR) in 45 to 55 year old men and women.
Aerospace Medical Association Preprints, 1979. p. 47–48.

75 **Convertino, V.A., J.L. Polet, K.A. Engelke, G.W. Hoffler, L.D. Lane, and C.G. Blomqvist:**
Increased ß-adrenergic responsiveness induced by 14 days exposure to simulated microgravity.
Journal of Gravitational Physiology 2:P-66–P-67, 1995.

76 **Convertino, V.A., and H. Sandler:**
Effect of age on peak VO_2 reduction associated with inactivity.
Medicine and Science in Sports and Exercise 13:94, 1981. (Abstract)

77 **Convertino, V.A., and H. Sandler:**
VO_2 kinetics during submaximal exercise following simulated weightlessness.
The Physiologist 25(Suppl.):S-159–S-160, 1982.

78 **Convertino, V.A., and H. Sandler:**
Exercise countermeasures for spaceflight.
Acta Astronautica 35:253–270, 1995.

79 **Convertino, V.A., H. Sandler, and P. Webb:**
The effect of an elastic reverse gradient garment on the cardiorespiratory deconditioning following 15-days bed rest.
Aerospace Medical Association Preprints, 1978. p. 148–149.

80 **Convertino, V.A., H. Sandler, P. Webb, and J.F. Annis:**
Induced venous pooling and cardiorespiratory responses to exercise after bed rest.
Journal of Applied Physiology 52:1343–1348, 1982.

81 **Convertino, V.A., R.W. Stremel, E.M. Bernauer, and J.E. Greenleaf:**
Cardiorespiratory responses to exercise after bed rest in men and women..
Aerospace Medical Associations Preprints, 1975. p. 238–239.

82 **Convertino, V.A., R.W. Stremel, E.M. Bernauer, and J.E. Greenleaf:**
Cardiorespiratory responses to exercise after bed rest in men and women.
Acta Astronautica 4:895–905, 1977.

83 **Crandall, C.G., K.A. Engelke, V.A. Convertino, and P.B. Raven:**
Aortic baroreflex control of heart rate following 15 days of simulated microgravity.
Federation of American Societies for Experimental Biology Journal 7:A666, 1993. (Abstract)

84 **Crandall, C.G., K.A. Engelke, V.A. Convertino, and P.B. Raven:**
Aortic baroreflex control of heart rate after 15 days of simulated microgravity exposure.
Journal of Applied Physiology 77:2134–2139, 1994.

85 **Crandall, C.G., K.A. Engelke, J.A. Pawelczyk, P.B. Raven, and V.A. Convertino:**
Spectral analysis of heart rate variability following 16 days simulated microgravity exposure.
Aviation, Space, and Environmental Medicine 64:459, 1993. (Abstract)

86 **Crandall, C.G., K.A. Engelke, J.A. Pawelczyk, P.B. Raven, and V.A. Convertino:**
Power spectral and time based analysis of heart rate variability following 15 days head-down bed rest.
Aviation, Space, and Environmental Medicine 65:1105–1109, 1994.

87 **Crandall, C.G., K.A. Engelke, P.B. Raven, and V.A. Convertino:**
Peripheral vascular responses to orthostatic challenge following deconditioning.
Medicine and Science in Sports and Exercise 25:S54, 1993. (Abstract)

88 **Crandall, C.G., J.M. Johnson, V.A. Convertino, P.B. Raven, and K.A. Engelke:**
Altered thermoregulatory responses after 15 days of head-down tilt.
Journal of Applied Physiology 77:1863–1867, 1994.

89 **Dallman, M.F., J. Vernikos, L.C. Keil, D. O'Hara, and V. Convertino:**
Hormonal, fluid and electrolyte responses to 6° anti-orthostatic bed rest in healthy male subjects.
In: *Stress. The Role of Catecholamines and Other Neurotransmitters,* Vol. II, edited by E. Usdin, R. Kvetnansky, and J. Axelrod. New York: Gordon and Breach Science Publishers, 1984. p. 1057–1077.

90 **DeCherney, G.S., M.F. Dallman, G. Van Loon, L.C. Keil, V.A. Convertino, D. O'Hara, and J. Vernikos-Danellis:**
Simulation of weightlessness: Hormonal, fluid and electrolyte consequences of 30 days –6° headdown bedrest.
Endocrine Society Abstracts, 1989. p. 466. (Abstract)

91 **Dempster, P.T., E.M. Bernauer, M. Bond, and J.E. Greenleaf:**
Proprioceptive Isokinetic Exercise Test.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 104015*, 1993. 10 p.

92 **DeRoshia, C.W.:**
The effect of exercise countermeasures upon performance and mood during antiorthostatic bedrest.
Aviation, Space, and Environmental Medicine 60:489, 1989. (Abstract)

93 **DeRoshia, C.W.:**
Performance and mood.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 21–25.

94 **DeRoshia, C.W.:**
The effect of habitability and selection upon human performance and mood during head down bed rest.
In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p.117–132.

95 **DeRoshia, C.W., and J.E. Greenleaf:**
Performance and mood-state parameters during 30-day 6° head-down bed rest with exercise training.
Aviation, Space, and Environmental Medicine 64:522–527, 1993.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 109-116.

96 **DeRoshia, C.W., Y. Kawai, G. Murthy, D.E. Watenpaugh, G.A. Breit, and A.R. Hargens:**
The effect of head-down tilt induced changes in cerebral blood flow upon human performance.
Aviation, Space, and Environmental Medicine 65:466, 1994. (Abstract)

97 **Dolkas, C.B., and J.E. Greenleaf:**
Insulin and glucose responses during bed rest with isotonic and isometric exercise.
Journal of Applied Physiology 43:1033–1038, 1977.

98 **Dolkas, C., and H. Sandler:**
Countermeasure effectiveness on abnormal glucose tolerance response during bed rest.
Aerospace Medical Association Preprints, 1974. p. 169–170.

99 **Dudley, G.A., M.R. Duvoisin, V.A. Convertino, and P. Buchanan:**
Alterations of the *in vivo* torque-velocity relationship of human skeletal muscle following 30 days exposure to simulated microgravity.
Aviation, Space, and Environmental Medicine 60:659–663, 1989.

100 **Dudley, G.A., P.D. Gollnick, V.A. Convertino, and P. Buchanan:**
Changes of muscle function and size with bedrest.
The Physiologist 32(Suppl.):S-65–S-66, 1989.

101 **Duvoisin, M.R., V.A. Convertino, P. Buchanan, P.D. Gollnick, and G.A. Dudley:**
Characteristics and preliminary observations of the influence of electromyostimulation on the size and function of human skeletal muscle during 30 days of simulated microgravity.
Aviation, Space, and Environmental Medicine 60:671–678, 1989.

102 **Ellis, S., and L.C. Kirby:**
Muscle ultrasound.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 41–44.

103 **Ellis, S., L.C. Kirby, and J.E. Greenleaf:**
Lower extremity muscle thickness during 30-day 6° head-down bed rest with isotonic and isokinetic exercise training.
Aviation, Space, and Environmental Medicine 64:1011–1015, 1993.

104 **Ellis, S., P.L. Lee, D.A. Ortendahl, R.H. Selzer, L.C. Kirby, and J.E. Greenleaf:**
Lower extremity muscle thickness during 30-day 6° head-down bed rest with isotonic and isokinetic exercise training.
In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 85–95.

105 **Ellis, S., P. Lee, and R. Selzer:**
Muscle magnetic resonance imaging.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 35–39.

106 **Engelke, K.A., C.G. Crandall, and V.A. Convertino:**
Decreased VO_2 max following detraining is not reversed by maximal exercise-induced increases in plasma volume.
Medicine and Science in Sports and Exercise 25: S36, 1993. (Abstract)

107 **Engelke, K.A., C.G. Crandall, and V.A. Convertino:**
Effects of a single bout of exhaustive exercise on integrated baroreflex function following bedrest.
Medicine and Science in Sports and Exercise 26:S132, 1994. (Abstract)

108 **Engelke, K.A., C.G. Crandall, and V.A. Convertino:**
Use of maximal exercise as a countermeasure for maintenance of orthostatic tolerance after exposure to 16 days of simulated microgravity.
Aviation, Space, and Environmental Medicine 65:463, 1994. (Abstract)

109 **Engelke, K.A., D.F. Doerr, and V.A. Convertino:**
A single bout of exhaustive exercise affects integrated baroreflex function after 16 days of head-down tilt.
American Journal of Physiology 269:R614–R620, 1995.

110 **Engelke, K.A., B.D. Levine, and V.A. Convertino:**
Maximal exercise-induced changes in leg blood flow following 16 days of head-down tilt.
Medicine and Science in Sports and Exercise 27:S187, 1995. (Abstract)

111 **Ertl, A.C.:**
Plasma Volume Shifts and Exercise Thermoregulation with Water Immersion and Six-Degree Head-Down Tilt.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 108781*, 1994. 30 p.

112 **Ertl, A.C., A.S. Dearborn, and J. Vernikos:**
The effect of intermittent standing or walking during head down tilt bedrest on peak O_2 consumption.
Aviation, Space, and Environmental Medicine 63:449, 1992. (Abstract)

113 **Fortney, S.M., V.S. Schneider, and J.E. Greenleaf:**
The physiology of bed rest.
In: *Handbook of Physiology: Section 4: Environment Physiology. III: The Gravitational Environment*, edited by M.J. Fregly, and C.M. Blatteis. New York: Oxford University Press, Vol. II, Chapt. 39, 1996. p. 889–939.

114 **Gander, P.H., L.J. Connell, and R.C. Graeber:**
Masking of the circadian rhythms of heart rate and core temperature by the rest-activity cycle in man.
Journal of Biological Rhythms 1:119–135, 1986.

115 **Gander, P.H., R.C. Graeber, and L.J. Connell:**
Masking of the circadian rhythms of heart rate and core temperature by the rest/activity rhythm in man.
Sleep Research 14:298, 1985. (Abstract)

116 **Ghista, D.N., A. Bhattacharya, H. Sandler, and E.P. McCutcheon:**
Indices characterizing cardiovascular deconditioning following bed rest using LBNP.
Aerospace Medical Association Preprints, 1976. p. 224–225.

117 **Goldberger, A.L., D. Goldwater, and V. Bhargava:**
Atrophine unmasks bed-rest effect: A spectral analysis of cardiac interbeat intervals.
Journal of Applied Physiology 61:1843–1848, 1986.

118 **Goldwater, D.J., and V.A. Convertino:**
$+3G_z$ tolerance in aerobically-trained and sedentary men after shuttle flight simulation.
Aviation, Space, and Environmental Medicine 59:485, 1988. (Abstract)

119 **Goldwater, D.J., V.A. Convertino, and H. Sandler:**
Acceleration tolerance in 55 to 65 year old men after shuttle flight simulation.
Aerospace Medical Association Preprints, 1981. p. 179–180.

120 **Goldwater, D.J., M. DeLada, A. Polese, L. Keil, and J.A. Luetscher:**
Effect of athletic conditioning on orthostatic tolerance after prolonged bedrest.
Circulation 62(Part II):III-287, 1980. (Abstract)

121 **Goldwater, D., L. Montgomery, G.W. Hoffler, H. Sandler, and R. Popp:**
Echocardiographic and peripheral vascular responses of men (ages 46 to 55) to lower body negative pressure (LBNP) following 10 days of bed rest.
Aerospace Medical Association Preprints, 1979. p. 51–52.

122 **Goldwater, D.J., D.B. O'Hara, and H. Sandler:**
Increased hematuria following hypergravic exposure in middle-aged women.
The Physiologist 25(Suppl.):S-167–S-170, 1982.

123 **Goldwater, D., A. Polese, L. Montgomery, L. London, P. Johnson, D. Yuster, and H. Sandler:**
Comparison of orthostatic intolerance following horizontal or -6^{o} head-down bed rest simulation of weightlessness.
Aerospace Medical Association Preprints, 1980. p. 28–29.

124 **Goldwater, D., A. Polese, S. Rositano, and H. Sandler:**
Use of Doppler transcutaneous flowmeter for measurement of left ventricular ejection time.
Circulation 60(Part II):II-125, 1979. (Abstract)

125 **Goldwater, D., D. Recktenwald, R. Bargatze, M. Peacock, J. Vernikos, J. Evans, T. Eames, and A.J. Robinson:**
Immunological effects of gravitational stress and simulated microgravity.
In: *Director's Discretionary Fund Report for FY 1991.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103902*, 1992. p. 15–17.

126 **Goldwater, D.J., and H. Sandler:**
Orthostatic and acceleration tolerance in 55 to 65 y.o. men and women after weightlessness simulation.
Aerospace Medical Association Preprints, 1982. p. 202–203.

127 **Goldwater, D., H. Sandler, and L. Montgomery:**
Exercise capacity, hematology, & body composition of females during bedrest shuttle flight simulation.
Aerospace Medical Association Preprints, 1978. p. 146–147.

128 **Goldwater, D., H. Sandler, L. Montgomery, and R. Popp:**
Bed rest effects on orthostatic responses of men and women.
Clinical Research 26:235A, 1978. (Abstract)

129 **Goldwater, D., H. Sandler, S. Rositano, and E.P. McCutcheon:**
Cardiovascular deconditioning during bedrest shuttle flight simulation.
Aerospace Medical Association Preprints, 1977. p. 240-241.

130 **Gowen, R.J., L.D. Montgomery, E.P. McCutcheon, and H. Sandler:**
Comparison of an impedance device to a capacitive plethysmograph for study of lower body pooling in man.
Aerospace Medical Association Preprints, 1977. p. 158–159.

131 **Greenleaf, J.E.:**
Effect of exercise on the pseudodiabetes of bed rest.
In: *Space Gerontology*, edited by J. Miquel, and A.C. Economos. NASA Ames Research Center, Moffett Field, CA: *NASA Conference Publication 2248*, 1982. p. 67–73.

132 **Greenleaf, J.E.:**
Fizjologia bezczynnosci ruchowej (Clinical physiology of bed rest).
In: *Wprowadzenie do Fizjologii Klinicznej (Introduction to Clinical Physiology),* edited by S. Kozlowski, and K. Nazar. Warszawa: Panstwowy Zaklad Wydawnictw Lekarskich, 1984. p. 356–377.

133 **Greenleaf, J.E.:**
Physiological responses to prolonged bed rest and fluid immersion in humans.
Journal of Applied Physiology 57:619–633, 1984.

134 Greenleaf, J.E.:
Physiology of fluid and electrolyte responses during inactivity: Water immersion and bed rest.
Medicine and Science in Sports and Exercise 16:20–25, 1984.

135 Greenleaf, J.E.:
Mechanisms for negative water balance during weightlessness: Immersion or bed rest?
The Physiologist 28(Suppl.):S-38–S-39, 1985.

136 Greenleaf, J.E.:
Physiology of prolonged bed rest.
In: *Angiologie*, edited by H. Boccalon. Paris: John Libbey Eurotext, 1988. p. 665–671.

137 Greenleaf, J.E.:
Physiology of Prolonged Bed Rest.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101010*, 1988. 9 p.

138 Greenleaf, J.E.:
Energy and thermal regulation during bed rest and spaceflight.
Journal of Applied Physiology 67:507–516, 1989.

139 Greenleaf, J.E. (editor):
Exercise Countermeasures for Bed Rest Deconditioning.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. 58 p.

140 Greenleaf, J.E.:
Hormonal regulation of fluid and electrolytes during prolonged bed rest: Implications for microgravity.
In: *Hormonal Regulation of Fluid and Electrolytes*, edited by J.R. Claybaugh, and C.E. Wade. New York: Plenum Publishing Corp., 1989. p. 215–232.

141 Greenleaf, J.E.:
Physiology of prolonged bed rest.
NASA Tech Briefs 15:68, 1991.

142 Greenleaf, J.E.:
The metabolic "cost" of physical exercise training by astronauts in microgravity.
Aviation, Space, and Environmental Medicine 63:150, 1992. (Letters to the editor)

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 35.

143 **Greenleaf, J.E. (editor):**
Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. 220 p.

144 **Greenleaf, J.E.:**
Fizjologia bezcynnosci ruchowej. (Clinical physiology of bed rest).
In: *Wprowadzenie do Fizjologii Klinicznej (Introduction to Clinical Physiology)*, edited by S. Kozlowski, and K. Nazar. Warszawa: Wydawnictwo Lekarskie PZWL, 1995. p. 330–350.

Greenleaf, J.E.:
Clinical physiology of bed rest.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 104010*, 1993. 25 p.

145 **Greenleaf, J.E., and E.M. Bernauer:**
Effects of exercise during bed rest.
NASA Tech Briefs 17:102, 1993.

146 **Greenleaf, J.E., E.M. Bernauer, and M. Bond:**
Exercise training programs.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 7–14.

147 **Greenleaf, J.E., E.M. Bernauer, A.C. Ertl, R. Bulbulian, and M. Bond:**
Isokinetic strength and endurance during 30-day 6^{o} head-down bed rest with isotonic and isokinetic exercise training.
Aviation, Space, and Environmental Medicine 65:45–50, 1994.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 37–44.

148 **Greenleaf, J.E., E.M. Bernauer, A. Ertl, D. McKenzie, G. Myers, and T. Trowbridge:**
Maintenance of peak O_2 uptake during 30-day bed rest deconditioning with isotonic and isokinetic exercise training.
Federation Proceedings 46:678, 1987. (Abstract)

149 **Greenleaf, J.E., E.M. Bernauer, A.C. Ertl, T.S. Trowbridge, and C.E. Wade:**
Work capacity during 30 days of bed rest with isotonic and isokinetic exercise training.
Journal of Applied Physiology 67:1820–1826, 1989.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 27–33.

150 Greenleaf, J.E., E.M. Bernauer, L.T. Juhos, H.L. Young, J.T. Morse, and R.W. Staley:
Effects of exercise on fluid exchange and body composition in man during 14-day bed rest.
Journal of Applied Physiology 43:126–132, 1977.

151 Greenleaf, J.E., E.M. Bernauer, H.L. Young, J.T. Morse, R.W. Staley, L.T. Juhos, and W. Van Beaumont:
Fluid and electrolyte shifts during bed rest with isometric and isotonic exercise.
Journal of Applied Physiology 42:59–66, 1977.

152 Greenleaf, J.E., R. Bulbulian, E.M. Bernauer, W.L. Haskell, and T. Moore:
Exercise-training protocols for astronauts in microgravity.
Journal of Applied Physiology 67:2191–2204,1989.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987*, 1993. p. 53–66.

153 Greenleaf, J.E., C.J. Greenleaf, D. Van Derveer, and K.J. Dorchak:
Adaptation to Prolonged Bedrest in Man: A Compendium of Research.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum X-3307*, 1976. 183 p.

154 Greenleaf, J.E., R.F. Haines, E.M. Bernauer, J.T. Morse, H. Sandler, R. Armbruster, L. Sagan, and W. Van Beaumont:
$+G_Z$ tolerance in man after 14-day bedrest periods with isometric and isotonic exercise conditioning.
Aviation, Space, and Environmental Medicine 46:671–678, 1975.

155 Greenleaf, J.E., C.G.R. Jackson, and D. Lawless:
Immune response and function: Exercise conditioning versus bed-rest and spaceflight deconditioning.
Sports Medicine, Training and Rehabilitation 5:223–241, 1994.

156 Greenleaf, J.E., L.T. Juhos, and H.L. Young:
Plasma lactic dehydrogenase activities in men during bed rest with exercise training.
Aviation, Space, and Environmental Medicine 56:193–198, 1985.

157 Greenleaf, J.E., J. Kollias, E.M. Bernauer, B.D. Newsom, and W. Van Beaumont:
Fluid and electrolyte shifts during $+G_Z$ acceleration after bed rest.
Medicine and Science in Sports 6:86, 1974. (Abstract)

158 Greenleaf, J.E., and S. Kozlowski:
Reduction in peak $\dot{V}O_2$ after bed rest is independent of peak $\dot{V}O_2$ before bed rest.
Federation Proceedings 40:498, 1981. (Abstract)

159 **Greenleaf, J.E., and S. Kozlowski:**
Physiological consequences of reduced physical activity during bed rest.
In: *Exercise and Sport Sciences Reviews,* Vol. 10, edited by R.L. Terjung. Philadelphia: Franklin Institute Press, 1982. p. 84–119.

160 **Greenleaf, J.E., and S. Kozlowski:**
Reduction in peak oxygen uptake after prolonged bed rest.
Medicine and Science in Sports and Exercise 14:477–480, 1982.

161 **Greenleaf, J.E., P.L. Lee, S. Ellis, R.H. Selzer, and D.A. Ortendahl:**
Leg Muscle Volume During 30-Day 6-Degree Head-Down Bed Rest with Isotonic and Isokinetic Exercise Training.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 4580*, 1994. 14 p.

162 **Greenleaf, J.E., and M. Matter, Jr.:**
Effect of Heat Acclimation on Sitting Orthostatic Tolerance in the Heat after 48 and 96 Hour Bed Rest in Men.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 108861*, 1995. 10 p.

163 **Greenleaf, J.E., and R.D. Reese:**
Impaired exercise thermoregulation after 14-days of bed rest.
The Physiologist 21:46, 1978. (Abstract)

164 **Greenleaf, J.E., and R.D. Reese:**
Exercise thermoregulation after 14 days of bed rest.
Journal of Applied Physiology 48:72–78, 1980.

165 **Greenleaf, J.E., L. Silverstein, J. Bliss, V. Langenheim, H. Rossow, and C. Chao:**
Physiological Responses to Prolonged Bed Rest and Fluid Immersion in Man: A Compendium of Research (1974–1980).
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 81324*, 1982. 115 p.

166 **Greenleaf, J., R.A. Staley, and P.A. Payne:**
New system for bathing bedridden patients.
NASA Tech Brief B73-10272, August, 1973.

167 **Greenleaf, J., R. Staley, and P.A. Payne:**
Portable shower for bed patients.
American Journal of Nursing 74:2021, 1974.

168 **Greenleaf, J., H.O. Stinnett, G.L. Davis, J. Kollias, and E.M. Bernauer:**
Fluid and electrolyte shifts in women during $+G_z$ acceleration after 15 days' bed rest.
Journal of Applied Physiology 42:67–73, 1977.

169 **Greenleaf, J.E., W. Van Beaumont, E.M. Bernauer, R.F. Haines, H. Sandler, H.L. Young, and J.W. Yusken:**
+G_Z tolerance after 14 days bed rest and the effects of rehydration.
Aerospace Medical Association Preprints, 1972. p. 112–113.

170 **Greenleaf, J.E., W. Van Beaumont, E.M. Bernauer, R.F. Haines, H. Sandler, H.L. Young, and J.W. Yusken:**
Effects of rehydration on +G_Z tolerance after 14-days bed rest.
Aerospace Medicine 44:715–722, 1973.

171 **Greenleaf, J.E., W. Van Beaumont, V.A. Convertino, and J.C. Starr:**
Handgrip and general muscular strength and endurance during prolonged bedrest with isometric and isotonic leg exercise training.
Aviation, Space, and Environmental Medicine 54:696–700, 1983.

172 **Greenleaf, J.E., J. Vernikos-Danellis, C.E. Wade, and P.R. Barnes:**
Effect of intermittent isotonic and isokinetic leg exercise training on vascular volumes during 30 days of –6° head-down bed rest.
Proceedings of the XXXI International Union of Physiological Sciences, 1989. p. 435. (Abstract)

173 **Greenleaf, J.E., J. Vernikos, C.E. Wade, and P.R. Barnes:**
Effect of leg exercise training on vascular volumes during 30 days of 6° head-down bed rest.
Journal of Applied Physiology 72:1887–1894, 1992.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987,* 1993. p. 77–84.

174 **Greenleaf, J.E., J. Vernikos, C.E. Wade, and P.R. Barnes:**
Effect of leg exercise on vascular volumes during bed rest.
NASA Tech Briefs 17:96, 1993.

175 **Greenleaf, J.E., and C.E. Wade:**
Orthostatic (tilt-table tolerance).
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 15–20.

176 **Greenleaf, J.E., C.E. Wade, E.M. Bernauer, T.S. Trowbridge, and A.C. Ertl:**
Isotonic and isokinetic exercise during bed rest.
NASA Tech Briefs 17:90–91, 1993.

177 **Greenleaf, J.E., C.E. Wade, and G. Leftheriotis:**
Orthostatic responses following 30-day bed rest deconditioning with isotonic and isokinetic exercise training.
Aviation, Space, and Environmental Medicine 60:537–542, 1989.

In: *Exercise Countermeasures for Bed-Rest Deconditioning (1986): Final Report,* edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103987,* 1993. p. 67–72.

178 **Greenleaf, J.E., H.L. Young, E.M. Bernauer, R.H. Armbruster, L.A. Sagan, R.W. Staley, L. Juhos, W. Van Beaumont, and H. Sandler:**
Effects of isometric and isotonic exercise on body water compartments during 14 days bed rest.
Aerospace Medical Association Preprints, 1973. p. 23–24.

179 **Haines, R.F.:**
Effect of bedrest and positive radial acceleration upon peripheral visual response time.
Aerospace Medical Association Preprints, 1972. p. 116–117.

180 **Haines, R.F.:**
Effect of passive 70° head-up tilt on peripheral visual response time.
Journal of Applied Physiology 34:329–333, 1973.

181 **Haines, R.F.:**
Effect of prolonged bedrest and $+G_Z$ acceleration upon peripheral visual response time.
Aerospace Medicine 44:425–432, 1973.

182 **Haines, R.F.:**
Effect of prolonged bedrest with exercise on body balance.
Aerospace Medical Association Preprints, 1973. p. 17–18.

183 **Haines, R.F.:**
Effect of bed rest and exercise on body balance.
Journal of Applied Physiology 36:323–327, 1974.

184 **Hargens, A.R.:**
Recent bed rest results and countermeasure development at NASA.
Acta Physiologica Scandinavica 150(Suppl. 616):103–114, 1994.

185 **Hargens, A.R.:**
Local fluid shifts and edema in humans during simulated microgravity.
In: *Proceedings of the First Joint NASA Cardiopulmonary Workshop.*
Washington, DC: *NASA Conference Publication 10068,* 1991. p. 109–119.

186 **Hargens, A.R., S.T. Hsieh, G. Murthy, R.E. Ballard, and V.A. Convertino:**
Sixteen-day bedrest significantly increases plasma colloid osmotic pressure.
Aviation, Space, and Environmental Medicine 66:485, 1995. (Abstract)

187 **Hargens, A.R., K.J. Hutchinson, G. Murthy, D.E. Watenpaugh, V.A. Convertino, and P.C. Wing:**
Back pain during 6° head-down tilt is similar to that during microgravity.
Aviation, Space, and Environmental Medicine 64:435, 1993. (Abstract)

188 **Hargens, A.R., S.E. Parazynski, and M. Aratow:**
Physiologic mechanisms of fluid shifts in humans during acute, simulated microgravity.
NASA Ames Research Center, Moffett Field, CA: *1990 Research and Technology*, 1990. p. 348.

189 **Hargens, A.R., S. Parazynski, M. Aratow, J.-U. Meyer, A. Crenshaw, and R. Whalen:**
Exercise and tissue-fluid shift studies at NASA-Ames Research Center.
Advances in Bioengineering 15:155–156, 1989. (Abstract)

190 **Hargens, A.R., S.E. Parazynski, D.E. Watenpaugh, M. Aratow, G. Murthy, and Y. Kawai:**
Mechanism of headward fluid shift during exposure to microgravity.
Pathophysiology 1(Suppl.):364, 1994. (Abstract)

191 **Hargens, A.R., D.E. Watenpaugh, and G.A. Breit:**
Control of circulatory function in altered gravitational fields.
The Physiologist 35(Suppl.): S-80–S-83, 1992.

192 **Hargens, A.R., R.T. Whalen, D.E. Watenpaugh, D.F. Schwandt, and L.P. Krock:**
Lower body negative pressure to provide load bearing in space.
Aviation, Space, and Environmental Medicine 62:934–937, 1991.

193 **Harris, B.A., B. Silver, J.E. Greenleaf, and S.B. Arnaud:**
Alterations in intracellular calcium during bedrest with and without exercise.
Journal of Bone and Mineral Research 2(Suppl. 1):Abstract 338, 1987. (Abstract)

194 **Hikida, R.S., P.D. Gollnick, G.A. Dudley, V.A. Convertino, and P. Buchanan:**
Structural and metabolic characteristics of human skeletal muscle following 30 days of simulated microgravity.
Aviation, Space, and Environmental Medicine 60:664–670, 1989.

195 **Hutchinson, K.J., A.R. Hargens, G. Murthy, D.E. Watenpaugh, V.A. Convertino, and P.C. Wing:**
Back pain during 6-degree head-down tilt is similar to that during actual microgravity.
NASA Ames Research Center, Moffett Field, CA: *1992 Research and Technology*, 1992. p. 209–210.

196 **Hutchinson, K.J., A.R. Hargens, G. Murthy, D.E. Watenpaugh, V.A. Convertino, and P.C. Wing:**
6° head-down tilt as a back pain model for actual microgravity.
Federation of American Societies for Experimental Biology Journal 7:A666, 1993. (Abstract)

197 **Hutchinson, K.J., D.E. Watenpaugh, G. Murthy, V.A. Convertino, and A.R. Hargens:**
Back pain during 6° head-down tilt approximates that during actual microgravity.
Aviation, Space, and Environmental Medicine 66:256–259, 1995.

198 **Jex, H.R., R.A. Peters, R.J. DiMarco, and R. W. Allen:**
The Effects of Bedrest on Crew Performance During Simulated Shuttle Reentry. Vol. II: Control Task Performance.
Washington, DC: *NASA Contractor Report 2367*, 1974. 97 p.

199 **Juhos, L.T., H.L. Young, and J.E. Greenleaf:**
Total LDH activity and its isoenzyme patterns during bed rest with exercise training.
The Physiologist 25:305, 1982. (Abstract)

200 **Kates, R.E., S.R. Harapat, D.L.D. Keefe, D. Goldwater, and D.C. Harrison:**
Influence of prolonged recumbency on drug disposition.
Clinical Pharmacology and Therapeutics 28:624–628, 1980.

201 **Kawai, Y., G. Murthy, C.W. DeRoshia, D.E. Watenpaugh, G.A. Breit, and A.R. Hargens:**
Head-down tilt increases cerebral blood flow velocity in humans.
Federation of American Societies for Experimental Biology Journal 6:A1771, 1992. (Abstract)

202 **Kawai, Y., G. Murthy, D.E. Watenpaugh, G.A. Breit, C.W. DeRoshia, and A.R. Hargens:**
Cerebral blood flow velocity in humans exposed to 24 h of head-down tilt.
Journal of Applied Physiology 74:3046–3051, 1993.

203 **Kawai, Y., G. Murthy, D.E. Watenpaugh, and A.R. Hargens:**
Cerebral blood flow velocity increases with acute head-down tilt of humans.
The Physiologist 34:257, 1991. (Abstract)

204 **Kawai, Y., G. Murthy, D.E. Watenpaugh, and A.R. Hargens:**
Cerebral blood flow velocity increases with acute head-down tilt of humans.
The Physiologist 35(Suppl.):S-186–S-187, 1992.

205 **Kawai, Y., M.S. Stout, and G. Murthy:**
Circulatory changes during simulated microgravity.
NASA Ames Research Center, Moffett Field, CA: *1991 Research and Technology*, 1991. p. 238–239.

206 **Keil, L.C., and S. Ellis:**
Plasma vasopressin and renin activity in women exposed to bed rest and $+G_z$ acceleration.
Journal of Applied Physiology 40:911–914, 1976.

207 **Keller, E.E.:**
The Effects of Exposure to Bright Light on Cognitive Performance.
San Jose State University, San Jose, CA: Department of Psychology Master Thesis, 1992. 63 p.

208 **Kultgen, B.L., and M.R. Pack:**
Ames research bedrest facility, stress testing and physical effects of two weeks of bedrest.
Aerospace Medical Association Preprints, 1974. p. 106–107.

209 **Leach, C.S., J. Vernikos-Danellis, J.M. Krauhs, and H. Sandler:**
Endocrine and Fluid Metabolism in Males and Females of Different Ages After Bedrest, Acceleration, and Lower Body Negative Pressure.
NASA Johnson Space Center, Houston, TX: *NASA Technical Memorandum 58270,* 1985. 46 p.

210 **Leuken, S., S. Arnaud, A.K. Taylor, and D.J. Baylink:**
Immobilization causes an acute and sustained increase in markers of bone resorption.
Clinical Research 38:123A, 1990. (Abstract)

211 **Leuken, S.A., S.B. Arnaud, A.K. Taylor, and D.J. Baylink:**
Changes in markers of bone formation and resorption in a bed rest model of weightlessness.
Journal of Bone and Mineral Research 8:1433–1438, 1993.

212 **Leuken, S., S. Arnaud, A.K. Taylor, K.H.W. Lau, V. Perkel, and D.J. Baylink:**
Bed rest causes an acute and progressive increase in skeletal resorption in normal men: Indirect evidence that this is mediated by osteocalcin.
Journal of Bone and Mineral Research 4(Suppl. 1):S308, 1989. (Abstract)

213 **Ludwig, D.A., V.A. Convertino, D.J. Goldwater, and H. Sandler:**
Logistic risk model for the unique effects of inherent aerobic capacity on $+G_Z$ tolerance before and after simulated weightlessness.
Aviation, Space, and Environmental Medicine 58:1057–1061, 1987.

214 **Ludwig, D.A., J. Vernikos, M.R. Duvoisin, and J.L. Stinn:**
The efficacy of periodic $+1G_Z$ exposure in the prevention of bedrest induced orthostatic intolerance.
Aviation, Space, and Environmental Medicine 63:449, 1992. (Abstract)

215 **Luu, P.B., V. Ortiz, P.R. Barnes, and J.E. Greenleaf:**
Physiological Responses to Prolonged Bed Rest in Humans: A Compendium of Research (1981–1988).
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 102249,* 1990. 136 p.

216 **Martin, D.G., V.A. Convertino, D. Goldwater, E.W. Ferguson, and E.B. Schoomaker:**
Plasma viscosity elevations with simulated weightlessness.
Aviation, Space, and Environmental Medicine 57:426–431, 1986.

217 **Martin, D.G., E.W. Ferguson, E.B. Schoomaker, D. Devor, D. Goldwater, and H. Sandler:**
Plasma viscosity elevations with simulated weightlessness.
Aviation, Space, and Environmental Medicine 55:465, 1984.

218 **McCutcheon, E.P., and H. Sandler:**
Effect of venipuncture on cardiovascular responses to lower body negative pressure.
Aerospace Medical Association Preprints, 1975. p. 163–164.

219 **McCutcheon, E.P., and H. Sandler:**
Effects of simulated weightlessness on responses of female and male subjects to $+G_Z$ centrifugation.
Aerospace Medical Association Preprints, 1976. p. 222–223.

220 **McDonald, J.K., T.J. Reilly, B.B. Zeitman, J.E. Greenleaf, H. Sandler, and S. Ellis:**
Effect of prolonged bed rest and $+G_Z$ centrifugation on blood fibrinolytic activity in males and females and its possible use as a measure of vascular deconditioning.
Aerospace Medical Association Preprints, 1974. p. 167–168.

221 **Milbury, P.E., V.A. Convertino, M.R. Vaughan, and W.R. Matson:**
Immobility induced metabolic pattern changes in bears and human bedrest subjects: A model for immobility osteopenia.
American Society for Gravitational and Space Biology Bulletin 9:33, 1995. (Abstract)

222 **Montgomery, L.D.:**
Body volume changes during simulated weightlessness: An overview.
Aviation, Space, and Environmental Medicine 58(9, Suppl.):A80–A85, 1987.

223 **Montgomery, L.D.:**
Body volume changes during simulated microgravity. I: Technique and comparison of men and women during horizontal bed rest.
Aviation, Space, and Environmental Medicine 64:893–898, 1993.

224 **Montgomery, L.D.:**
Body volume changes during simulated microgravity. II: Comparison of horizontal and head-down bed rest.
Aviation, Space, and Environmental Medicine 64:899–904, 1993.

225 **Montgomery, L.D., and D. Goldwater:**
Body fluid redistribution and volume changes during horizontal and antiorthostatic bed rest.
Aerospace Medical Association Preprints, 1980. p. 22–23.

226 **Montgomery, L.D., D.J. Goldwater, S.A. Rositano, and H. Sandler:**
Peripheral blood flow responses of women (ages 35 to 45 years) to lower-body negative pressure as a consequence of nine days bed rest.
Aerospace Medical Association Preprints, 1978. p. 144–145.

227 **Montgomery, L.D., D. Goldwater, and H. Sandler:**
Hemodynamic response of men 46 to 55 years old to $+G_Z$ acceleration before and after bed rest.
Aerospace Medical Association Preprints, 1979. p. 45–46.

228 **Montgomery, L.D., and D.D. White:**
Pelvic blood pooling of men and women during lower body negative pressure.
Aviation, Space, and Environmental Medicine, 66:494, 1995. (Abstract)

229 **Morey-Holton, E.R., R.T. Whalen, S.B. Arnaud, and M.C. Van Der Meulen:**
The skeleton and its adaptation to gravity.
In: *Handbook of Physiology: Section 4: Environmental Physiology. III: The Gravitational Environment*, edited by M. J. Fregly, and C.M. Blatteis. New York: Oxford University Press: Vol. I, Chapt. 31, 1996. p. 691–719.

230 **Murthy, G., R.E. Ballard, G.A. Breit, D.E. Watenpaugh, and A.R. Hargens:**
Intramuscular pressures beneath elastic and inelastic leggings.
Annals of Vascular Surgery 8:543–548, 1994.

231 **Murthy, G., R.J. Marchbanks, D.E. Watenpaugh, J.-U. Meyer, N. Eliashberg, and A.R. Hargens:**
Increased intracranial pressure in humans during simulated microgravity.
The Physiologist 35(Suppl.):S-184–S-185, 1992.

232 **Murthy, G., D.E. Watenpaugh, R.E. Ballard, and A.R. Hargens:**
Exercise against lower body negative pressure as a countermeasure for cardiovascular and musculoskeletal deconditioning.
Acta Astronautica 33:89–96, 1994.

233 **Murthy, G., D.E. Watenpaugh, R.E. Ballard, and A.R. Hargens:**
Supine exercise during lower body negative pressure effectively simulates upright exercise in normal gravity.
Journal of Applied Physiology 76:2742–2748, 1994.

234 **Murthy, G., D.E. Watenpaugh, and A.R. Hargens:**
Increased intracranial pressure during simulated microgravity.
NASA Ames Research Center, Moffett Field, CA: *1991 Research and Technology*, 1991. p. 239–240.

235 **Murthy, G., W.T. Yost, R.E. Ballard, D.E. Watenpaugh, Y. Kawai, and A.R. Hargens:**
Ultrasound as a noninvasive method to assess changes of intracranial volume and pressure during simulated microgravity.
Pathophysiology 1(Suppl.):366, 1994. (Abstract)

236 **Myburgh, K.H., S. Charette, L. Zhou, C.R. Steele, S. Arnaud, and R. Marcus:**
Influence of recreational activity and muscle strength on ulnar bending stiffness in men.
Medicine and Science in Sports and Exercise 25:592–596, 1993.

237 **Myburgh, K.H., L.J. Zhou, C.R. Steele, S.B. Arnaud, and R. Marcus:**
In vivo assessment of forearm bone mass and ulnar bending stiffness in healthy men.
Journal of Bone and Mineral Research 7:1345–1350, 1992.

238 **Natelson, B.H., C.W. DeRoshia, J. Adamus, M.B. Finnegan, and B.E. Levin:**
Relations between visceral and behavioral function in men at bedrest.
The Pavlovian Journal of Biological Science 18:161–168, 1983.

239 **Natelson, B.H., C. DeRoshia, and B.E. Levin:**
Physiological effects of bed rest.
The Lancet I (8262):51, 1982.

240 **Natelson, B.H., D.J. Goldwater, C. DeRoshia, and B.E. Levin:**
Visceral predictors of cardiovascular deconditioning in late middle-aged men.
Aviation, Space, and Environmental Medicine 56:199–203, 1985.

241 **Newsom, B.D., W.L. Goldenrath, and H. Sandler:**
Tolerance of females to $+G_z$ centrifugation before and after bed rest.
Aerospace Medical Association Preprints, 1975. p. 141–142.

242 **Newsom, B.D., W.L. Goldenrath, W.R. Winter, and H. Sandler:**
Tolerance of females to $+G_z$ centrifugation before and after bedrest.
Aviation, Space, and Environmental Medicine 48:327–331, 1977.

243 **Pace, N., B.W. Grunbaum, A.M. Kodama, D.C. Price, and B.D. Newsom:**
Biochemical changes induced by bed rest in the human female.
Aerospace Medical Association Preprints, 1975. p. 143–144.

244 **Painter, P.L., V. Convertino, S. Bloomfield, J. Greenleaf, and G.E. Moore:**
Physiologic effects of bedrest and restricted physical activity–an update.
Medicine and Science in Sports and Exercise 25(Suppl.):S71, 1993. (Abstract)

245 **Parazynski, S.E., M. Aratow, B. Tucker, J. Styf, A. Crenshaw, and A.R. Hargens:**
Physiological mechanisms of tissue fluid shifts during acute, simulated weightlessness.
Aviation, Space, and Environmental Medicine 61:496, 1990. (Abstract)

246 **Parazynski, S.E., A.R. Hargens, B. Tucker, M. Aratow, J. Styf, and A. Crenshaw:**
Transcapillary Fluid Shifts in Head and Neck Tissues During and After Simulated Microgravity.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103847,* 1991. 18 p.

247 **Parazynski, S.E., A.R. Hargens, B. Tucker, M. Aratow, J. Styf, and A. Crenshaw:**
Transcapillary fluid shifts in tissues of the head and neck during and after simulated microgravity.
Journal of Applied Physiology 71:2469–2475, 1991.

248 **Parazynski S.E., A.R. Hargens, B. Tucker, J. Styf, A. Crenshaw, and M. Aratow:**
Cephalic tissue fluid pressures during acute, simulated microgravity.
American Society for Gravitational and Space Biology Bulletin 3:87, 1989. (Abstract)

249 **Parazynski, S.E., B.J. Tucker, M. Aratow, A. Crenshaw, and A.R. Hargens:**
Direct measurement of capillary blood pressure in the human lip.
Journal of Applied Physiology 74:946–950, 1993.

250 **Pelligra, R., H. Sandler, S. Rositano, K. Skrettingland, and R. Mancini:**
Advanced techniques for monitoring human tolerance to positive Gz acceleration.
Revue de Medicine Aeronautique et Spatiale 12:301–304, 1973.

251 **Polese, A., D. Goldwater, L. London, D. Yuster, and H. Sandler:**
Resting cardiovascular effects of horizontal (0^o) and head-down (-6^o) bed rest (BR) on normal men.
Aerospace Medical Association Preprints, 1980. p. 24–25.

252 **Polese, A., D. Goldwater, S.A. Rositano, and H. Sandler:**
Effect of bed rest and lower body negative pressure (LBNP) on left ventricular systolic time intervals.
Aerospace Medical Association Preprints, 1979. p. 49–50.

253 **Polese, A., H. Sandler, and L.D. Montgomery:**
Hemodynamic responses to seated and supine lower body negative pressure: Comparison with $+G_Z$ acceleration.
Aviation, Space, and Environmental Medicine 63:467–475, 1992.

254 **Popp, R.L., H. Sandler, and D.C. Harrison:**
Effect of bedrest on cardiac dynamics in males and females measured by echocardiography.
Circulation 50(Suppl. III):III-240, 1974. (Abstract)

255 **Robertson, D., V.A. Convertino, and J. Vernikos:**
The sympathetic nervous system and the physiologic consequences of spaceflight: A hypothesis.
The American Journal of the Medical Sciences 308:126–132, 1994.

256 **Samel, A., and P. Gander (editors):**
Light as a Chronobiologic Countermeasure for Long-Duration Space Operations. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. 74 p.

257 Samel, A., and P.H. Gander:
The circadian rhythm of temperature and its modeling.
In: *Light as a Chronobiologic Countermeasure for Long-Duration Space Operations.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. Chapt. 2, p. 9–20.

258 Samel, A., P.H. Gander, and R.C. Graeber:
Overview.
In: *Light as a Chronobiologic Countermeasure for Long-Duration Space Operations.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. Chapt. 1, p. 5–8.

259 Samel, A., P.H. Gander, J. Evans, H. Maass, W. Raabe, L. Keil, and R. C. Graeber:
Desynchronization and dissociation.
In: *Light as a Chronobiologic Countermeasure for Long-Duration Space Operations.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. Chapt. 3, p. 21–44.

260 Samel, A., P.H. Gander, R.C. Graeber, and H.M. Wegmann:
Response of the circadian system to shifted sleep-wake cycles and bright light exposure during head-down tilt (HDT).
Aviation, Space, and Environmental Medicine 62:476, 1991. (Abstract)

261 Samel, A., P.H. Gander, E. Hackett, and R.C. Graeber:
Performance and subjective assessments.
In: *Light as a Chronobiologic Countermeasure for Long-Duration Space Operations.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. Chapt. 5, p. 51–66.

262 Samel, A., P.H. Gander, M. Rountree, M. Rosekind, and R. C. Graeber:
Sleep.
In: *Light as a Chronobiologic Countermeasure for Long-Duration Space Operations.* NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 103874*, 1991. Chapt. 4, p. 45–50.

263 Sandler, H.:
Effects of bedrest and weightlessness on the heart.
In: *Hearts and Heart-Like Organs,* Vol. 2, edited by G.H. Bourne. New York: Academic Press, Inc., 1980. p. 435–524.

264 Sandler, H.:
Cardiovascular responses to weightlessness and ground-based simulations.
In: *Zero-g Simulation for Ground-Based Studies in Human Physiology, with Emphasis on the Cardiovascular and Body Fluid Systems,* edited by N. Longdon. Noordwijk, The Netherlands: ESA Scientific and Technical Publications Branch, 1982. p. 107–146. (ESA Special Publication 180)

265 Sandler, H.:
Are there limits to man's long-term presence in space?
Society of Automotive Engineers Paper 831132, 1983. 10 p.

266 Sandler, H.:
Cardiovascular responses to hypogravic environments.
In: *Space Physiology*, edited by J. Garcia, M. Guerin, and C. Laverlochere. Toulouse, France: Cepadues - Editions, 1983. p. 317–333.

267 Sandler, H.:
Human involvement in long-term space flight.
In: *Fourth International Symposium of University of Occupational and Environmental Health (UOEH) on Occupational Health in Aviation and Space Work, Kitakyushu, Japan*, edited by K. Tesuchiya. Journal of University of Occupational and Environmental Health 7:245–254, 1985.

268 Sandler, H.:
Cardiovascular effects of inactivity.
In: *Inactivity: Physiological Effects*, edited by H. Sandler, and J. Vernikos. Orlando: Academic Press, Inc., 1986. p. 11–47.

269 Sandler, H.:
Future outlook.
Business and Health 3(6):58–59, 1986.

270 Sandler, H.:
Cardiovascular Effects of Weightlessness and Ground-Based Simulation.
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 88314*, 1988. 102 p.

271 Sandler, H., and V.A. Convertino:
Limits to human performance. The view from space.
In: *Limits of Human Performance*, edited by D.H. Clarke, and H.M. Eckert. Champaign, IL: Human Kinetics Publishers, Inc., 1985. p. 130–137.

272 Sandler, H., D. Dolkas, J.F. Annis, and P. Webb:
Physiologic effects of induced venous pooling during simulated weightlessness.
Aerospace Medical Association Preprints, 1982. p. 204–205.

273 Sandler, H., D.J. Goldwater, M.W. Bungo, and R.L. Popp:
Changes in cardiovascular function: Weightlessness and ground-based studies.
In: *Results of Space Experiments in Physiology and Medicine and Informal Briefings by the F-16 Medical Working Group*. Neuilly-Sur-Seine, France: AGARD, NATO, 1984. p. 6-1–6-9.

274 Sandler, H., D.J. Goldwater, R.L. Popp, L. Spaccavento, and D.C. Harrison:
Beta blockade in the compensation for bed-rest cardiovascular deconditioning: Physiologic and pharmacologic observations.
American Journal of Cardiology 55:114D–119D, 1985.

275 **Sandler, H., D.J. Goldwater, and S.A. Rositano:**
Physiologic responses of female subjects during bed rest shuttle flight simulation.
Aerospace Medical Association Preprints, 1978. p. 142–143.

276 **Sandler, H., D. Goldwater, S.A. Rositano, C.F. Sawin, and C.R Booher:**
Physiologic response of male subjects ages 46 to 55 years to shuttle flight simulation.
Aerospace Medical Association Preprints, 1979. p. 43–44.

277 **Sandler, H., J.E. Greenleaf, B.D. Newsom, and S. Rositano:**
Lower-body negative pressure (LBNP) as a predictor for $+G_Z$ tolerance after bed rest (BR).
Aerospace Medical Association Preprints, 1974. p. 171–172.

278 **Sandler, H., J.E. Greenleaf, H.L. Young, E.M. Bernauer, J.T. Morse, R.W. Staley, R.F. Haines, and W. Van Beaumont:**
Effects of isometric and isotonic exercise during 14 days bed rest on $+G_Z$ tolerance.
Aerospace Medical Association Preprints, 1973. p. 21–22.

279 **Sandler, H., and A.I. Grigoriev:**
Joint US/USSR Study: Comparison of Effects of Horizontal and Head-Down Bed Rest.
Washington, DC: *NASA Technical Paper 3037*, 1990. 104 p.

280 **Sandler, H., E.P. McCutcheon, T.B. Fryer, S. Rositano, R. Westbrook, and P.J. Haro:**
Recent NASA contributions to biomedical telemetry.
American Psychologist 30:257–264, 1975.

281 **Sandler, H., R.L. Popp, and D.C. Harrison:**
The effects of repeated bed rest exposure.
Aviation, Space, and Environmental Medicine 56:489, 1985. (Abstract)

282 **Sandler, H., R.L. Popp, and D.C. Harrison:**
The hemodynamic effects of repeated bed rest exposure.
Aviation, Space, and Environmental Medicine 59:1047–1054, 1988.

283 **Sandler, H., R. Popp, and E.P. McCutcheon:**
Echocardiographic studies of bed rest induced changes during LBNP.
Aerospace Medical Association Preprints, 1977. p. 242–243.

284 **Sandler, H., S.A. Rositano, and E.P. McCutcheon:**
An objective determination of $+G_Z$ acceleration tolerance.
Acta Astronautica 4:541–553, 1977.

In: *Proceedings of the 27th International Astronautical Federation,* 1976. p. 1–7. (IAF-76-034)

285 **Sandler, H., and J. Vernikos (editors):**
Inactivity: Physiological Effects.
Orlando: Academic Press, Inc., 1986. 205 p.

286 **Sandler, H., P. Webb, J. Annis, N. Pace, B.W. Grunbaum, D. Dolkas, and B. Newsom:**
Evaluation of a reverse gradient garment for prevention of bed-rest deconditioning.
Aviation, Space, and Environmental Medicine 54:191–201, 1983.

287 **Sandler, H., and D.L. Winter:**
Physiological Responses of Women to Simulated Weightlessness. A Review of the Significant Findings of the First Female Bed-Rest Study.
Washington, DC: *NASA Special Publication 430*, 1978. 87 p.

288 **Sather, T.M., V.A. Convertino, and D.J. Goldwater:**
Cardiovascular adjustments associated with lower body negative pressure (LBNP) tolerance.
Aviation, Space, and Environmental Medicine 55:443, 1984. (Abstract)

289 **Sather, T.M., V.A. Convertino, D.J. Goldwater, G.M. Karst, and C.R. Kirby:**
Relationship between lower body negative pressure (LBNP) tolerance and maximal oxygen consumption in man.
International Journal of Sports Medicine 5:162, 1984. (Abstract)

290 **Sather, T.M., V.A. Convertino, D.J. Goldwater, L.C. Keil, R. Kates, and L.D. Montgomery:**
Cardiovascular and vasoactive neuroendocrine responses associated with orthostatic tolerance and $\dot{V}O_2$ max in man.
Medicine and Science in Sports and Exercise 17:229, 1985. (Abstract)

291 **Sather, T.M., V.A. Convertino, D.J. Goldwater, L.C. Keil, R. Kates, and L.D. Montgomery:**
Vasoactive neuroendocrine responses associated with orthostatic tolerance in man.
Federation Proceedings 44:817, 1985. (Abstract)

292 **Sather, T.M., V.A. Convertino, D.J. Goldwater, and L.D. Montgomery:**
Relationship between lower body negative pressure (LBNP) tolerance and maximal oxygen consumption ($\dot{V}O_2$ max) in man.
Medicine and Science in Sports and Exercise 16:112, 1984. (Abstract)

293 **Sather, T.M., D.J. Goldwater, L.D. Montgomery, and V.A. Convertino:**
Midthigh-leg circulatory responses to lower body negative pressure (LBNP) after 8 days of headdown bedrest.
Aviation, Space, and Environmental Medicine 56:489, 1985. (Abstract)

294 **Sather, T.M., D.J. Goldwater, L.D. Montgomery, and V.A. Convertino:**
Cardiovascular dynamics associated with tolerance to lower body negative pressure.
Aviation, Space, and Environmental Medicine 57:413–419, 1986.

295 **Shvartz, E., V.A. Convertino, L.C. Keil, and R.F. Haines:**
Orthostatic fluid-electrolyte and endocrine responses in fainters and nonfainters.
Journal of Applied Physiology 51:1404–1410, 1981.

296 **Shimizu, M., D.N. Ghista, and H. Sandler:**
The importance of abdominal pressure for blood volume distribution and central venous pressure change during head-down tilt.
The Physiologist 21:109, 1978. (Abstract)

297 **Shimizu, M., D.N. Ghista, and H. Sandler:**
Cardiovascular regulatory response to lower body negative pressure following blood volume loss.
Aviation, Space, and Environmental Medicine 50:24–33, 1979.

298 **Silver, B.B., B.A. Harris, J.E. Greenleaf, and S.B. Arnaud:**
Intracellular ion concentrations in bed rest subjects treated with exercise.
Journal of the American College of Nutrition 6:454, 1987. (Abstract)

299 **Snow-Harter, C., K. Myburgh, B. Lewis, S. Charette, S. Arnaud, and R. Marcus:**
Bone mineral density, muscle strength, and physical activity in men.
Clinical Research 39:100A, 1991. (Abstract)

300 **Snow-Harter, C., R. Whalen, K. Myburgh, S. Arnaud, and R. Marcus:**
Bone mineral density, muscle strength, and recreational exercise in men.
Journal of Bone and Mineral Research 7:1291–1296, 1992.

301 **Spaccavento, L.J., D. Goldwater, R. Kates, and R.L. Popp:**
The effects of bedrest and lower body negative pressure on cardiac function.
Journal of the American College of Cardiology 5:538, 1985. (Abstract)

302 **Starr, J.C., J.E. Greenleaf, W. Van Beaumont, and V.A. Convertino:**
Handgrip and general muscular strength and endurance during prolonged bedrest with isometric and isotonic leg exercise training.
The Physiologist 25:304, 1982. (Abstract)

303 **Stout, M.S., D.E. Watenpaugh, G.A. Breit, and A.R. Hargens:**
The effects of simulated microgravity on regional cutaneous microcirculatory blood flow.
Federation of American Societies for Experimental Biology Journal 6:A1771, 1992. (Abstract)

304 **Stout, M.S., D.E. Watenpaugh, G.A. Breit, and A.R. Hargens:**
Simulated microgravity increases cutaneous blood flow in the head and leg of humans.
Aviation, Space, and Environmental Medicine 66:872–875, 1995.

305 **Stremel, R.W., V.A. Convertino, E.M. Bernauer, and J.E. Greenleaf:**
Cardiorespiratory deconditioning with static and dynamic leg exercise during bed rest.
Journal of Applied Physiology 41:905–909, 1976.

306 **Stremel, R.W., V.A. Convertino, J.E. Greenleaf, and E.M. Bernauer:**
Response to maximal exercise after bedrest.
Federation Proceedings 33:327, 1974. (Abstract)

307 **Taylor, A.K., S. Arnaud, B. Barr, S. Leuken, P. Bettica, and D. Baylink:**
Urine pyridinium crosslinks correlate better with serum osteocalcin than with other bone resorption markers during a prospective bedrest study.
Journal of Bone and Mineral Research 6(Suppl. 1):S244, 1991. (Abstract)

308 **Torikoshi, S., M.H. Wilson, R.E. Ballard, D.E. Watenpaugh, G. Murthy, W.T. Yost, J.H. Cantrell, D.S. Chang, and A.R. Hargens:**
Ultrasound measurement of transcranial distance during head-down tilt.
Journal of Gravitational Physiology 2:P-145–P-146, 1995.

309 **Van Beaumont, W., and J.E. Greenleaf:**
Comparative changes in plasma protein concentration, hematocrit and plasma volume during exercise, bedrest and + G_Z acceleration.
Aerospace Medical Association Preprints, 1972. p. 114–115.

310 **Van Beaumont, W., J.E. Greenleaf, and J. Davis:**
Erythrocyte volume with +G_Z centrifugation in women after 15-days' bed rest.
Aerospace Medical Association Preprints, 1974. p. 61.

311 **Van Beaumont, W., J.E. Greenleaf, and L. Juhos:**
Disproportional changes in hematocrit, plasma volume, and proteins during exercise and bed rest.
Journal of Applied Physiology 33:55–61, 1972.

312 **Van Beaumont, W., J.E. Greenleaf, H.L. Young, and L. Juhos:**
Plasma volume and blood constituent shifts during + G_Z acceleration after bedrest with exercise conditioning.
Aerospace Medicine 45:425–430, 1974.

313 **Van Beaumont, W., H.L. Young, and J.E. Greenleaf:**
Influence of isometric and isotonic exercise during bedrest on changes in plasma volume, plasma protein concentration and content during + G_Z acceleration.
Aerospace Medical Association Preprints, 1973. p. 19–20.

314 **Vernikos, J.:**
Metabolic and endocrine changes.
In: *Inactivity: Physiological Effects,* edited by H. Sandler, and J. Vernikos. Orlando: Academic Press, Inc., 1986. p. 99–121.

315 **Vernikos, J.:**
Hormonal regulation of fluid and electrolyte metabolism in zero-g and bedrest.
In: *Proceedings of the First Joint NASA Cardiopulmonary Workshop.*
Washington, DC: *NASA Conference Publication 10068*, 1991. p. 121–139.

316 **Vernikos, J., and V.A. Convertino:**
Advantages and disadvantages of fludrocortisone or saline load in preventing post-spaceflight orthostatic hypotension.
Acta Astronautica 33: 259–266, 1994.

317 **Vernikos, J., M.F. Dallman, L. Keil, and D. O'Hara:**
Plasma renin activity increases and aldosterone decreases during head-down bedrest.
Endocrine Society Abstracts, 1980. p. 250. (Abstract)

318 **Vernikos, J., M.F. Dallman, L.C. Keil, D. O'Hara, and V.A. Convertino:**
Gender differences in endocrine responses to posture and 7 days of -6^{o} head-down bed rest.
American Journal of Physiology 265:E153–E161, 1993.

319 **Vernikos, J., M.F. Dallman, G. Van Loon, and L.C. Keil:**
9 α-fluorohydrocortisone and atropine/d-amphetamine as a countermeasure for post-bedrest orthostatic intolerance.
Aviation, Space, and Environmental Medicine 58:497, 1987. (Abstract)

320 **Vernikos, J., M.F. Dallman, G. Van Loon, and L.C. Keil:**
Drug effects on orthostatic intolerance induced by bedrest.
Journal of Clinical Pharmacology 31:974–984, 1991.

321 **Vernikos, J., L. Keil, A.C. Ertl, C.E. Wade, J.E. Greenleaf, D. O'Hara, and D. Ludwig:**
The value of the 4-day headdown bedrest model for screening countermeasures.
Aviation, Space, and Environmental Medicine 63:449, 1992. (Abstract)

322 **Vernikos, J., and D.A. Ludwig:**
Intermittent Gravity: How Much, How Often, How Long?
NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 108800*, 1994. 102 p.

Burton, R., and J. Vernikos:
Artificial gravity: How much, how often, how long?
Aviation, Space, and Environmental Medicine 63:449, 1992. (Abstract)

323 **Vernikos, J., D.A. Ludwig, and V.A. Convertino:**
Comparison of saline and fludrocortisone as fluid-loading countermeasures following exposure to simulated microgravity.
Aviation, Space, and Environmental Medicine 63:388, 1992. (Abstract)

324 **Vernikos-Danellis, J., M.F. Dallman, P. Forsham, A.L. Goodwin, and C.S. Leach:**
Hormonal indices of tolerance to $+G_z$ acceleration in female subjects.
Aviation, Space, and Environmental Medicine 49:886–889, 1978.

325 **Vernikos-Danellis, J., M.F. Dallman, A.E. Goodwin, and C.S. Leach:**
The pituitary-adrenal response to $+G_z$ before and after bedrest in female subjects.
Aerospace Medical Association Preprints, 1975. p. 145–146.

326 **Vernikos-Danellis, J., C.M. Winget, A.E. Goodwin, and T. Reilly:**
Comparison of hormone and electrolyte circadian rhythms in male and female humans.
Waking and Sleeping 1:365–368, 1977.

327 **Wade, C.E., J.E. Greenleaf, L.C. Keil, M.M. Hunt, and J. Vernikos:**
Acute neuroendocrine responses to orthostasis following 30 days of bedrest: Effects of exercise training.
Federation of American Societies for Experimental Biology Journal 5:A1130, 1991. (Abstract)

328 **Wade, C.E., L.C. Keil, M.M. Hunt, and J.E. Greenleaf:**
Acute hormonal responses to head-down tilt versus supine posture.
Medicine and Science in Sports and Exercise 20:S48, 1988. (Abstract)

329 **Wade, C.E., L.C. Keil, and J. Vernikos:**
Hormonal responses to exercise and orthostasis.
In: *Exercise Countermeasures for Bed Rest Deconditioning*, edited by J.E. Greenleaf. NASA Ames Research Center, Moffett Field, CA: *NASA Technical Memorandum 101045*, 1989. p. 45–54.

330 **Wade, C.E., J. Vernikos, J. Evans, and D. O'Hara:**
Periodic upright posture negates the suppression of neuroendocrine response to head down bedrest.
Aviation, Space, and Environmental Medicine 63:449, 1992. (Abstract)

331 **Watenpaugh D.E., R.E. Ballard, G.A. Breit, E.M. Bernauer, C.G. Blomqvist, and A.R. Hargens:**
Calf venous compliance measured with head-up tilt equals supine calf compliance.
Journal of Gravitational Physiology 2:P-21–P-22, 1995.

332 **Watenpaugh, D.E., R.E. Ballard, M.S. Stout, G. Murthy, R.T. Whalen, and A.R. Hargens:**
Dynamic leg exercise improves tolerance to lower body negative pressure.
Aviation, Space, and Environmental Medicine 65:412–418, 1994.

333 **Watenpaugh, D.E., G.A. Breit, R.E. Ballard, and A.R. Hargens:**
Monitoring acute whole-body fluid redistribution by changes in leg and neck volume.
Federation of American Societies for Experimental Biology Journal 6:A1771, 1992. (Abstract)

334 **Watenpaugh, D.E., G.A. Breit, R.E. Ballard, G. Murthy, and A.R. Hargens:**
Fluid redistribution and heart rate in humans during whole-body tilting, G_Z centrifugation, and lower body negative pressure.
American Society for Gravitational and Space Biology Bulletin 8:35, 1994. (Abstract)

335 **Watenpaugh, D.E., G.A. Breit, R.E. Ballard, S. Zietz, and A.R. Hargens:**
Human neck compliance exceeds leg compliance.
NASA Ames Research Center, Moffett Field, CA: *1993 Research and Technology*, 1993. p. 198.

336 **Watenpaugh, D.E., and A.R. Hargens:**
The cardiovascular system in microgravity.
In: *Handbook of Physiology: Section 4: Environmental Physiology. III: The Gravitational Environment*, edited by M.J. Fregly, and C.M. Blatteis. New York: Oxford University Press. Vol. I, Chapt. 29, 1996. p. 631–674.

337 **Westbrook, R.M., P.J. Haro, and T.B. Fryer:**
Long-term monitoring of EKG and body temperature from ambulatory subjects.
Aerospace Medical Association Preprints, 1975. p. 5–6.

338 **Westbrook, R.M., B. Williams, and H. Sandler:**
Long term use of a swallowable temperature transmitter..
Aerospace Medical Association Preprints, 1973. p. 127–128.

339 **Whalen, R.T., S.B. Arnaud, T. Tamanaha, T. Hutchinson, and J. Vogel:**
Relation of calcaneal bone density to measures of daily physical activity.
Journal of Bone and Mineral Research 6(Suppl. 1):S249, 1991. (Abstract)

340 **Whalen, R.T., T. Tamanaha, and S.B. Arnaud:**
Loading-dependent variations in regional bone density and lean body mass.
Journal of Bone and Mineral Research 7(Suppl. 1):S189, 1992. (Abstract)

341 **Williams, B.A., and R.D. Reese:**
Effect of bedrest on thermoregulation.
Aerospace Medical Association Preprints, 1972. p. 140–141.

342 **Williams, D.A., and V.A. Convertino:**
Circulating lactate and FFA during exercise: Effect of reduction in plasma volume following exposure to simulated microgravity.
Aviation, Space, and Environmental Medicine 59:1042–1046, 1988.

343 **Williams, D.A., D.J. Goldwater, and V.A. Convertino:**
Relationship between plasma volume and blood lactate during exercise following simulated weightlessness.
Aviation, Space, and Environmental Medicine 56:489, 1985. (Abstract)

344 **Winget, C.M., L.F. Chapman, D.A. Rockwell, J. Vernikos-Danellis, and J.R. Beljan:**
Human circadian rhythms: Psychological, performance and physiological deconditioning in the aeronautics and astronautics environment.
Chronobiologia 6:173–174, 1979. (Abstract)

345 **Winget, C.M., and C.W. DeRoshia:**
Influences of horizontal hypokinesia on performance and circadian physiological rhythms in female humans.
The Physiologist 22:134, 1979. (Abstract)

346 **Winget, C.M., and C.W. DeRoshia:**
Psychosocial and chronophysiological effects of inactivity and immobilization.
In: *Inactivity: Physiological Effects*, edited by H. Sandler, and J.Vernikos. Orlando: Academic Press, Inc., 1986. p. 123–147.

347 **Winget, C.M., C.W. DeRoshia, and H. Sandler:**
The effect of bedrest and confinement on circadian rhythm synchrony of female subjects.
Aerospace Medical Association Preprints, 1976. p. 254–255.

348 **Winget, C.M., C.W. DeRoshia, and H. Sandler:**
Influences of horizontal hypokinesia on performance and circadian physiological rhythms in female humans.
The Physiologist 22(Suppl.):S-79–S-80, 1979.

349 **Winget, C.M., C.W. DeRoshia, J. Vernikos-Danellis, W.S. Rosenblatt, and N.W. Hetherington:**
Comparison of circadian rhythms in male and female humans.
Waking and Sleeping 1:359–363, 1977.

350 **Young, H.L., L. Juhos, B.L. Castle, J. Yusken, and J.E. Greenleaf:**
Body Water Compartments During Bed Rest: Evaluation of Analytical Methods.
Washington, DC: *NASA Technical Report R-406*, 1973. 22 p.

Acknowledgement

The authors thank Dr. C.G.R. Jackson, Becky Wermer, and Ticia Gummere for word processing assistance.

Author Index by Publication Number

E

F

G

H

J

K

L

M

T

V

W

Y

Z

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	April 1996	Technical Memorandum

4. TITLE AND SUBTITLE

Publications from Biomedical Research Conducted in the NASA Ames Research Center Human Research Facility: 1972–1995

5. FUNDING NUMBERS

199-18-12-07

6. AUTHOR(S)

J. E. Greenleaf, C. W. DeRoshia, V. L. Reyna, and K. A. Oswald

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Ames Research Center
Moffett Field, CA 94035-1000

8. PERFORMING ORGANIZATION REPORT NUMBER

A-961428

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

NASA TM-110391

11. SUPPLEMENTARY NOTES

Point of Contact: J. E. Greenleaf, Ames Research Center, MS 239-11, Moffett Field, CA 94035-1000; (415) 604-6604

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Unclassified — Unlimited
Subject Category 51

12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 words)***

Publications (abstracts, papers, and review articles) resulting from prolonged (> 24 hour) bed-rest projects and short-term (< 24 hour) head-down tilt or bed rest studies conducted on men and women in the Human Research Facility, Life Science Division at Ames Research Center, from 1972 to 1995 are presented herein. These publications report findings from (a) basic research into the mechanism(s) of human short-term adaptation and deconditioning during exposure to short- and long-term bed rest; (b) evaluation of countermeasures for the deleterious effects of both shifted timing of sleep-wake schedules and deconditioning utilizing bed rest as a simulation for spaceflight; and (c) development and evaluation of biomedical equipment and instrumentation for application to astronauts, general clinical medicine, and research.

Citations include mainly those documents that have been published in retrievable form; i.e., containing volume, pages, and year. Thus, some unpublished papers, meeting reports, and abstracts have been omitted.

An author index is provided.

14. SUBJECT TERMS

Bed rest, Human research, Head-down tilt

15. NUMBER OF PAGES

46

16. PRICE CODE

A03

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified		